

Remarks

Amendments to Claims

Independent claim 1 has been amended to more clearly define the invention. Claim 1 is directed to a method of laser welding in which a laser beam forms a molten weld pool to fuse two members. In accordance with the welding method, a heating source supplemental to the welding laser is used to heat a zone of the members to slow the rate of solidification of the laser beam-produced weld molten pool to avoid the retention of pores in the solidified weld bead. The amendment to claim 1 more clearly states that the heated zone is around the molten metal pool produced by the laser beam.

The addition of this limitation to claim 1 is supported by Figure 4 and related specification text (paragraphs 0025-0027) in which heated zone 126 and heat-affected zone 124 are formed around molten weld trough 116. Molten weld trough 116 is produced by laser beam 22 and heated zones 124, 126 are produced by a separate and supplemental heater 122. Similarly, in Figure 5 and related text (paragraphs 0028 and 0029), welding laser beam 222a produces molten weld trough 216, and secondary laser beam 222b (fractionated from and extrinsic to welding beam 222a) heats zones 224, 226 around molten weld trough 216.

Thus the method of independent claim 1 uses two distinct heating sources to produce a weld. One source is the welding laser beam which is used to produce the temporary molten weld trough that eventually solidifies to form a weld bead. The second heating source, the supplemental heating source, is used to heat a zone around the temporary molten weld trough to delay solidification of the molten metal and minimize formation of pores in the weld bead.

Dependent claim 2 has been cancelled.

Independent claim 6 has been amended as suggested by the Examiner for allowability. Claim 6 now includes the limitation of original dependent claim 9. Claim 6 now requires that the supplemental heater be positioned at a surface opposite the surface to which the welding laser beam is directed.

Dependent claims 8-11 are cancelled.

Independent claim 12 has been amended to clearly require a supplemental heating source. Claim 12 has also been amended as suggested by the Examiner to include the limitation of its dependent claim 15.

Claims 14-17, originally dependent on claim 12, are cancelled.

It is believed that independent claims 6 and 12 and their remaining dependent claims 7 and 13 are allowable for the reasons given by the Examiner on page 4 of the Office Action dated November 16, 2005.

Rejections of the remaining Claims

Claims 1, 4, and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Okada (USPN 6,410,882). It is respectfully requested that this rejection of claims 1, 4, and 5 be reconsidered and withdrawn.

The Examiners objection to claim 3 as dependent on rejected claim 1 is noted. The Examiner is urged to reconsider this objection in view of the following arguments for the allowability of rejected independent claim 1.

Reasons for the allowability of Claims 1 and 3-5.

Independent claim 1 and its dependent claims 3-5 specify welding methods which use a laser beam to form the molten weld material and a supplemental heating source to separately heat a zone of the workpiece(s) around the molten metal pool. The separate heating source, whose thermal input can be controlled independently of the laser beam, is used to slow the solidification of the molten metal pool allowing gas to escape and a porosity-free weld bead to be formed. The Okada '882 patent does not teach or suggest a welding process using the combination of a laser beam to produce the molten weld material and a supplemental heating source to slow the solidification of the melt. Independent claim 1 is a method claim that clearly specifies the roles of both the welding laser beam and the heating source supplemental to the laser beam.

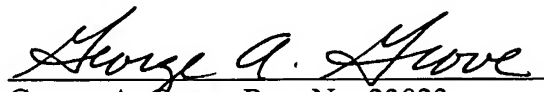
Okada is concerned with the suppression of porosity in laser welding. And Okada carefully manipulates his laser beam to reduce porosity. But Okada does not use a supplemental, independently controllable, heating source in his welding method.

Okada vibrates the focus position of the beam in the direction of the depth of the welded portion. The vibration of the welding beam may also be performed in a direction perpendicular to the optical axis. The fused pool is stirred and a keyhole at the center of the fused pool may be formed. But there is absolutely no description in the Okada disclosure of

using a second heating source to separately heat a zone in the work piece around the molten weld pool. Claims 1 and 3-5 clearly and distinctly define welding processes that are different from any concept contemplated by Okada. The rejection of claims 1 and 3-5 should be withdrawn.

It is respectfully requested that claims 1, 3-7, 12, and 13 be allowed and this case passed to issue.

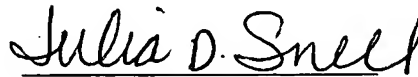
Respectfully Submitted,



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